AMS Short Course on Water Supply Forecasting

Hands on Exercise on Ensemble Streamflow Prediction and Verification

This exercise is designed to provide insight into the water supply forecast process. In particular, the exercise will provide a familiarization of ensemble forecasting and forecast verification. Please complete the following tasks and questions. The information you provide will also be used to improve the online tool.

For each question with a rating bar, *please rate the difficulty of completing each task on a scale of 1-5*, with 1 = very easy and 5 = very difficult. Also, if you have any questions or comments about the task, please write them in the space provided.

SECTION I: Demographics

1. Identify the sector which best describes your affiliation. ***Please select one****.*

Agriculture	
Development/Home Building	
Energy	
Forestry & Ecosystem Management	
Industry	
Media	
Planning	
Public Health	
Public Interest and Education	
Ranching	
Real Estate	
Research	
Tourism & Recreation	
Water Management	
Wildlife & Fisheries Management	
Other (please explain):	

2. What organization do you represent most of the time? ***Please select one****.*

Local Government	
Federal Government	
State Government	
Tribal Government	
Non-profit organization	
Private organization	
Other (please specify):	

3. For what geographical area(s) is climate of most concern to you? ***Select all that apply.***

Pacific Northwest including the Columbia Basin	
Colorado Basin	
California	
Great Basin	
Missouri Basin	
Rio Grande Basin	
Other US (please specify):	
National	
U.S.-Mexico border	
Global	
Other (please specify):	

SECTION II: Basic Website Navigation

4. In your web browser, go to http://wateroutlook.nwrfc.noaa.gov/ and click on the Western US Water Supply Map. Update the map to show forecast information for January 2011.
   Difficulty:

Very easy				Very difficult
1	2	3	4	5

   Comments: _____

5. Find the station called "Colorado River near Lake Granby, Granby, Co (GBYC2)." Go to this forecast point.
   Difficulty:

Very easy				Very difficult
1	2	3	4	5

   Comments: _____

6. a) What are the 50% and the 90% chances of exceedence for the *Seasonal Water Supply Forecast*?

   _____

b) What are the 50% and the 90% chances of exceedence for the *Seasonal Ensemble Outlook*?

_____

7. a) In your opinion, what are the differences between the information in the S*easonal Water Supply Forecast* and the *Seasonal Ensemble Outlook*?

_____

_____

b) Rollover the ? for both the Seasonal Water Supply Forecast and the Seasonal Ensemble Outlook. How useful is the information provided here?

Very useful				Not at all useful
1	2	3	4	5

c) Click on "Help" in the top toolbar, then click on "Point Summary." How useful is the information provided here?

Very useful				Not at all useful
1	2	3	4	5

SECTION III: Ensemble Forecasts

1. Click on the **Ensemble Plot** tab. What does this seasonal forecast distribution tell you?

_____

2. Now click on "Average Runoff" under "Archives". What does the forecast show relative to average?

3. What is the approximate forecast probability for below average streamflow in June?

4. Now click on last year's (2010) streamflow under "historical observations." How does this year's forecast compare to last year's observed streamflow?

5. What is the approximate forecast probability for the streamflow in July to be greater than it was in July 2010?

6. Under "season options," select April 2011 through July 2011. Then Select "Accumulation" and "Cumulative Distribution." What does this plot show?

---

7. What is the approximate forecasted probability that 2011's April – July inflow volume will be greater than the historical average for 2011?

---

8. Go back to the original plot (e.g. click "monthly" under "season options", unclick all the options under "archives"). Under "forecasts" click on "ENSO biased forecast" and select all La Nina trace years. How do the La Nina trace years compare to all trace years?

---

9. Play with all the Graph Options on the right.
   a. Do the provided functions and the charts they produce make sense?

      _____

   b. Which of the functions are most confusing?

      _____

   c. How might you use the information in this plot in your job?

   _____

   _____

10. Did you use any of the ? buttons on this page to help you through the previous two questions? If so, were they helpful?

    _____

    _____

SECTION IV: Forecast Verifcation

1. Click on the **Forecast Verification** tab. This section presents a number of analytical tools for evaluating past forecasts. The section is organized by forecast source, forecast period, years to verify, and a particular statistic.

2. Make a Historical plot using a Coordinated Forecast, for April-July during the years 2005-2009. How do you interpret the plot you just made?

_____

_____

3. Now make a scatterplot for all available years. What does this plot tell you about forecast skill for this point?

_____

_____

4. Using a new browser window, create the same plot for the John Day River at Monument (MONO3). How does forecast skill at this point compare to the Lake Granby point?

_____

_____

5. Go back to the Lake Granby plot and create the Mean Absolute Error (MAE) by month plot. What does this plot show?

_____

_____

6. Are the coordinated forecasts better than using climatology (threshold value: 225 KAF)? If so, by approximately how much?

_____

_____

7. Now compare the "Statistical Water Supply" and the "ESP – Empirical" forecast tools to the Coordinated forecasts using the same MAE (Months) plot. What tool performs the best in for the April forecast issuance?

_____

_____

8. Select the "skill score (months)" statistic. This statistic plots the percent improvement from a reference forecast. The reference forecast used here is the Threshold which is

generally climatology. What is the skill score for the coordinated forecast in April? What does this mean?

_____

_____

9. Now select the "POD Above Threshold" statistic.This calculates the probability of the median forecast being above the threshold value when the observed streamflow is above the threshold. What is the probability of detecting above average flows in April?

_____

In January? _____

How does this compare to detecting below average flows in April?

In January?

What pattern do you see? Try adjusting the threshold value to see if the pattern holds. Does it hold true for the John Day (MONO3) point?

_____

_____

10. Select the "Contingency Table" forecast statistic and ensure that your threshold value is set to "mean." What does the contingency table tell you about 2010? What does it tell you about the forecast skill in general for this location?

_____

_____

11. Note that every statistic calculated so far has used only the median ("most likely") forecast. Recall that water supply forecasts include a range of likely outcomes as well. Verifying these forecast ranges is an important component of verification. Select the "ranked histogram" statistic. This statistic simply counts the number of times that the observed streamflow falls above or below each forecast threshold. For forecasts using 10, 50, and 90% exceedence bounds such as GBYC2, this creates four categories (e.g. below the 90% value, between the 90% and 50% values, between the 50% and 10% values, and above the 10% value). The ranked histogram plot compares the actual distribution of observed streamflows in these four categories to their ideal distribution. Do you see a tendency for under or over forecasting? Is the forecast spread wide enough? Explain.

_____

_____

_____

_____

12. If time remains, explore the Graph Options on the right side of the Forecast Verification graph. Which features are the most useful? Are any important features missing?

    _____

    _____

13. Do you currently use forecast verification information? If yes, how do you use it?

    _____

    _____

14. Assume you get forecasts perfectly tailored to your interests (e.g. for the exact watershed you are interested in and for the exact time period of interest). What level of skill would make a forecast "good enough" to use? How would you know?

    _____

    _____

15. If time remains, explore some of the other capabilities on the web page. These include the forecast ranking table, climate variability plots, maps, data check-out, and the help pages.

16. After exploring the various capabilities of this online Water Resources Outlook, would you use it to help guide planning or decisions you make for your job?

    If yes, how might you use it?

    _____

    If no, why wouldn't you use it?

    _____

17. What are your overall impressions of this tool? This can include usability, usefulness, accuracy, etc.

    _____